

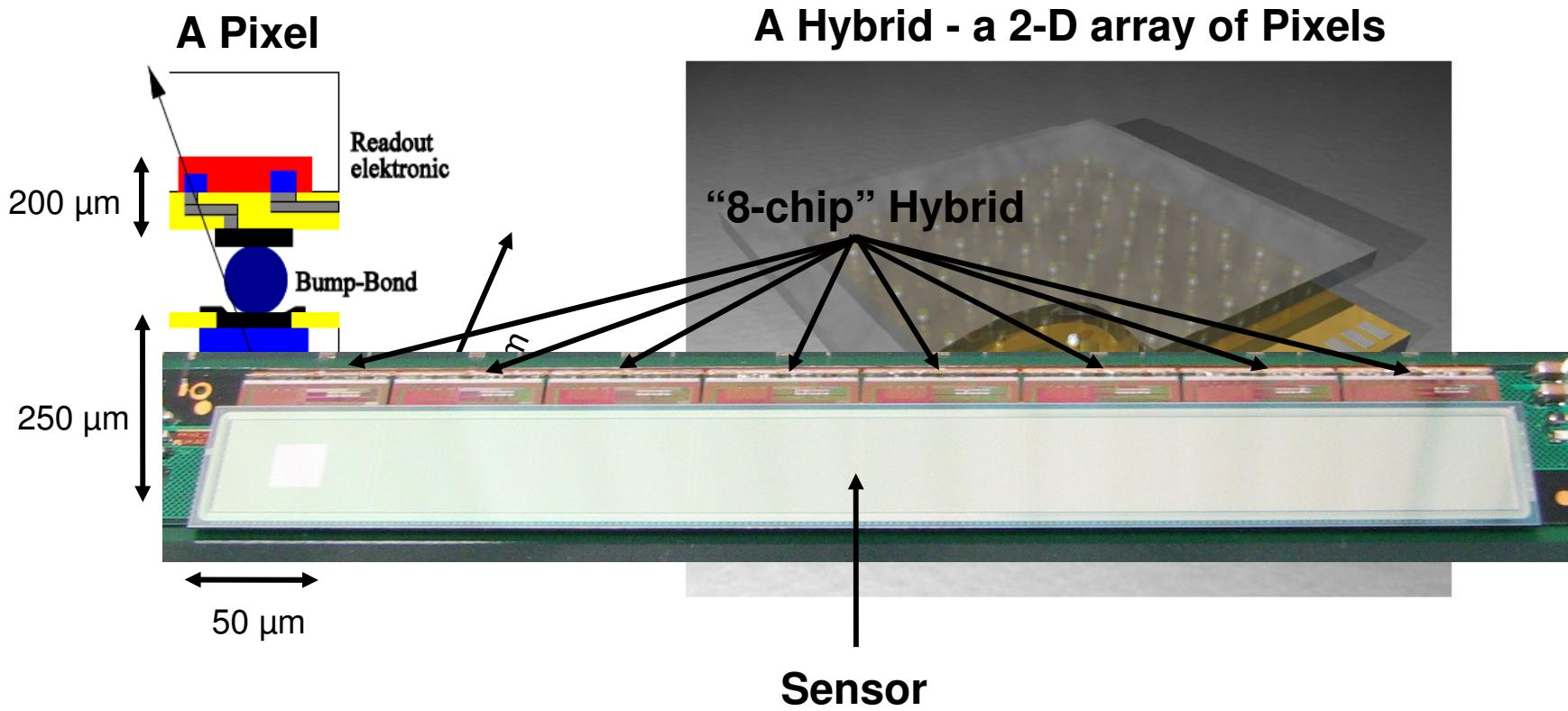
A Pixel Detector for MIPP using “BTeV Pixels”

David Christian

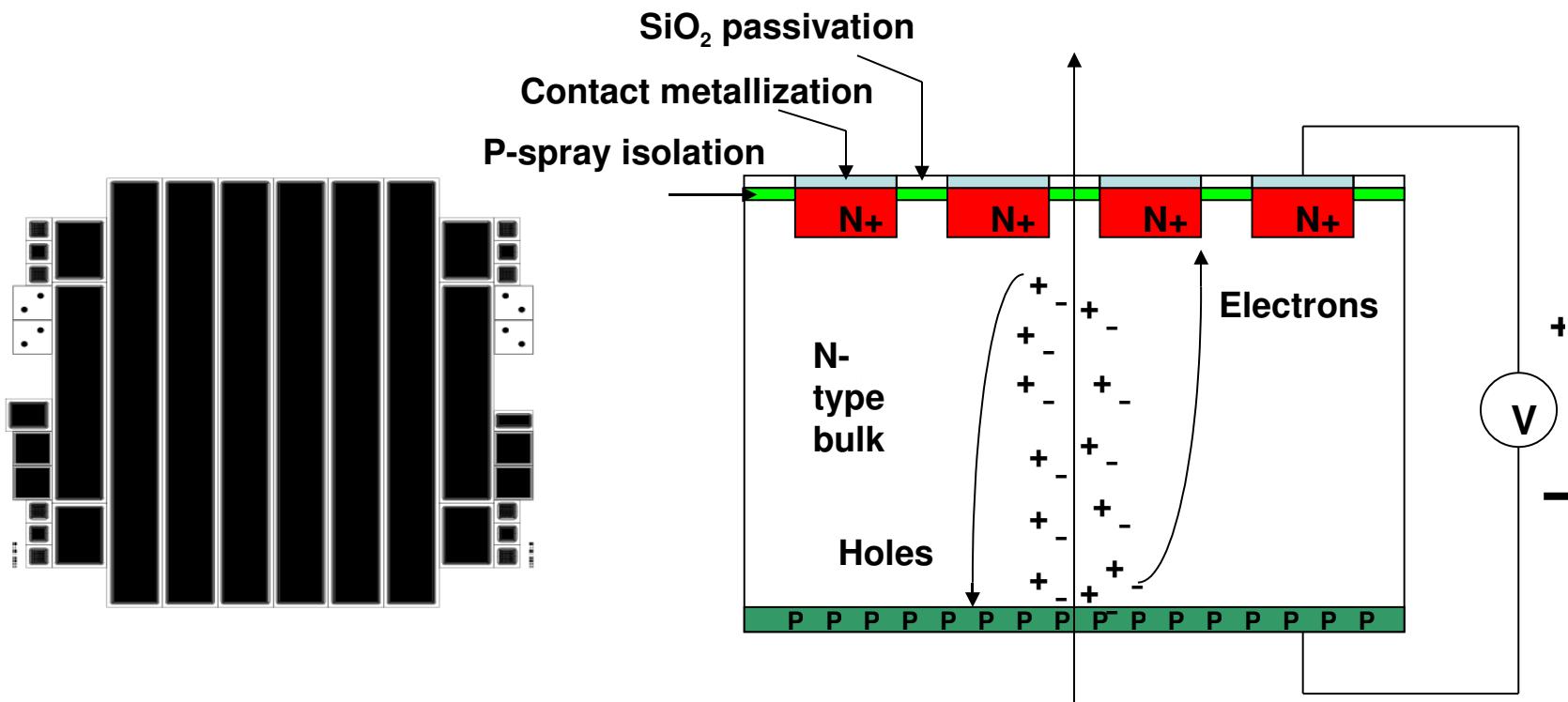
Fermilab

April 27, 2007

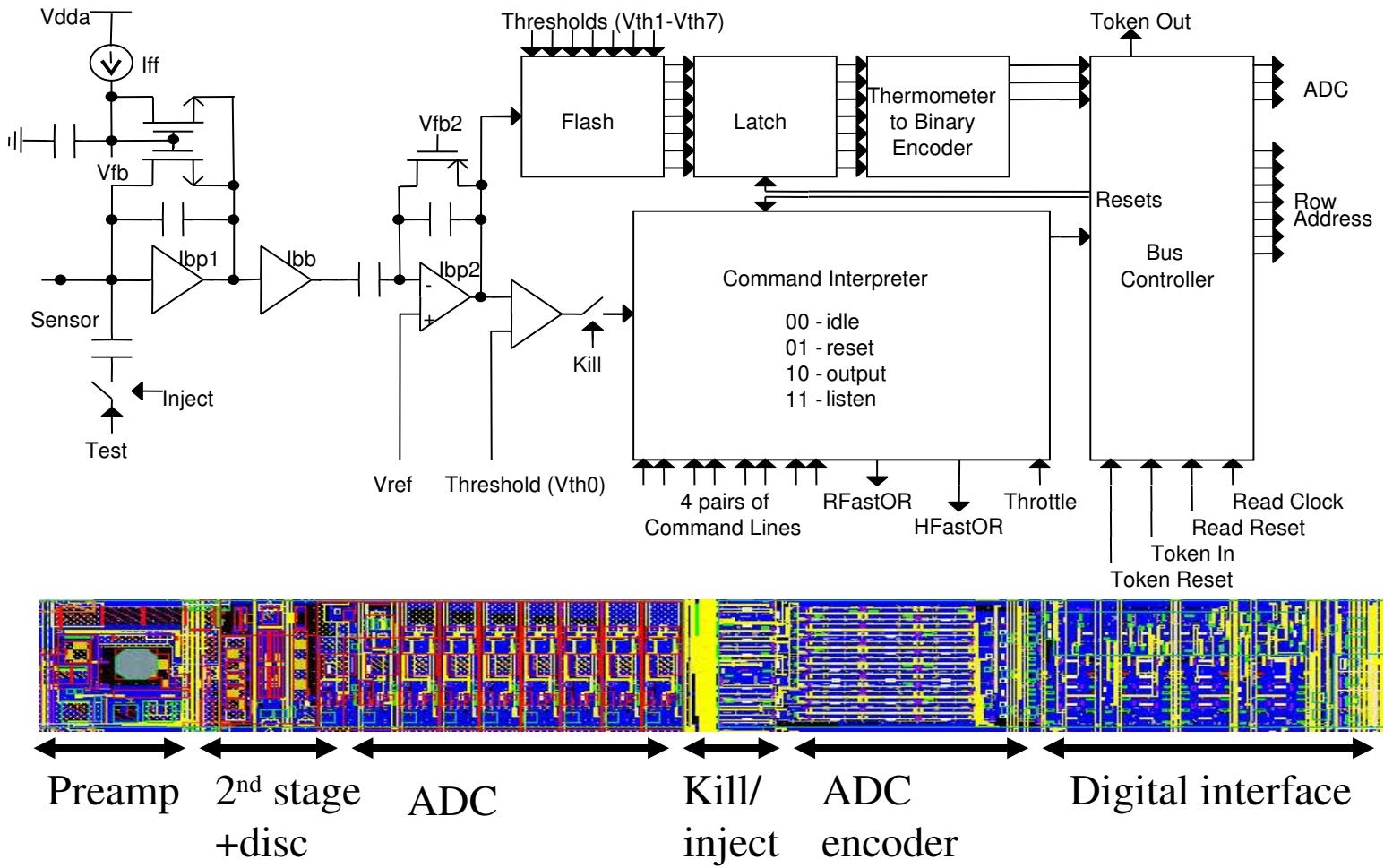
What is a Hybrid Pixel Detector?



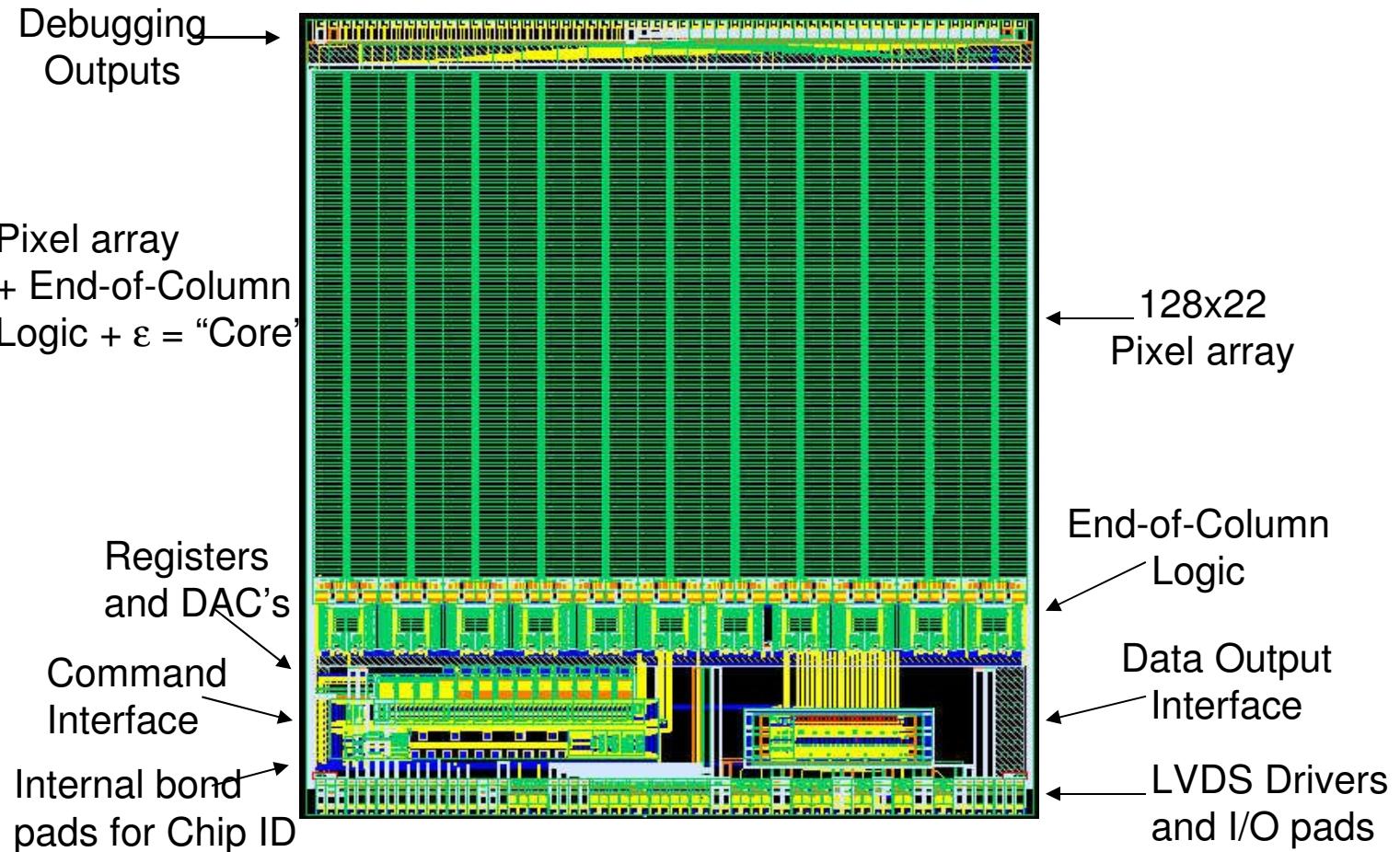
The Sensor



The readout IC



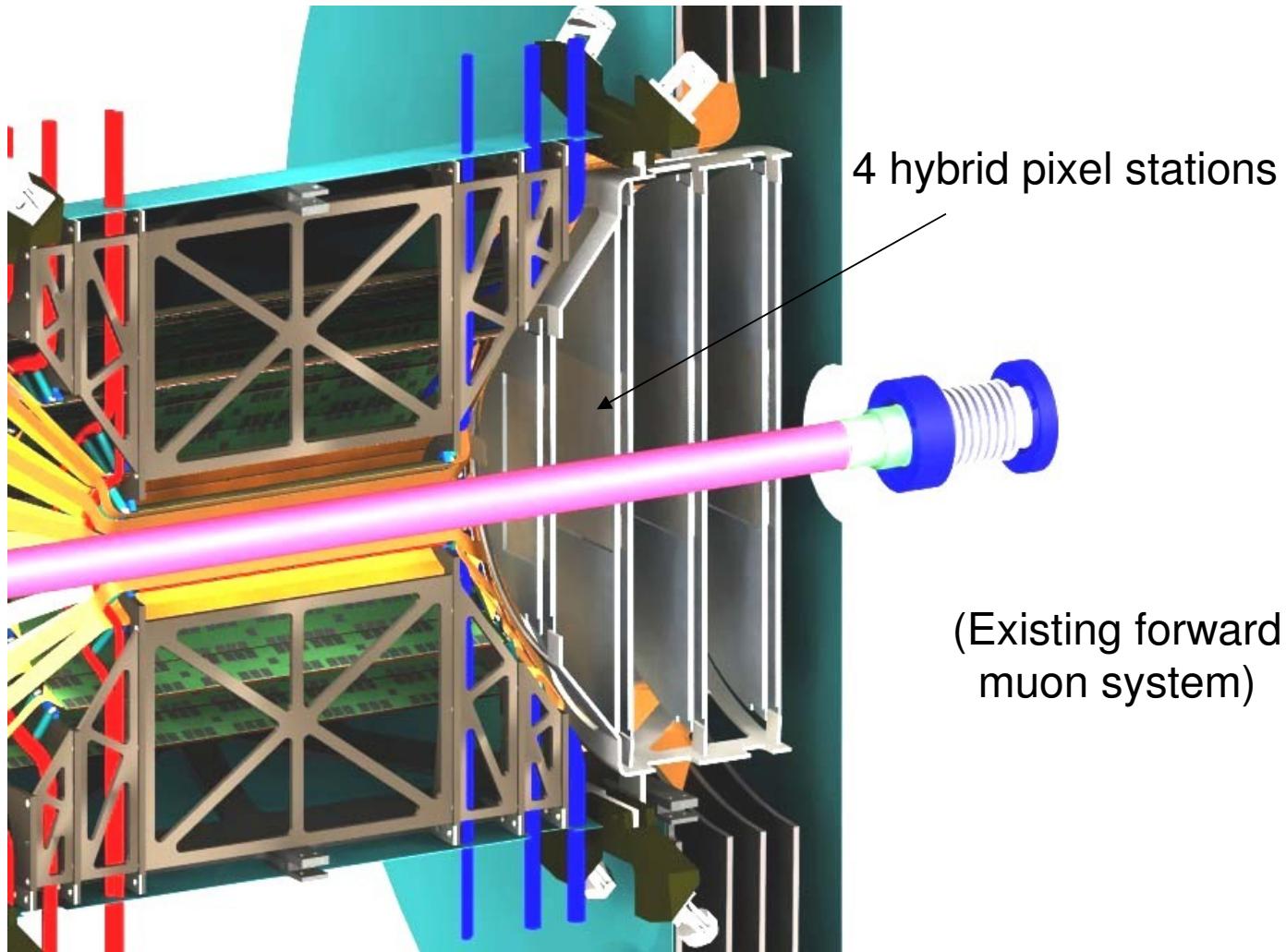
FPIX2 developed for BTeV



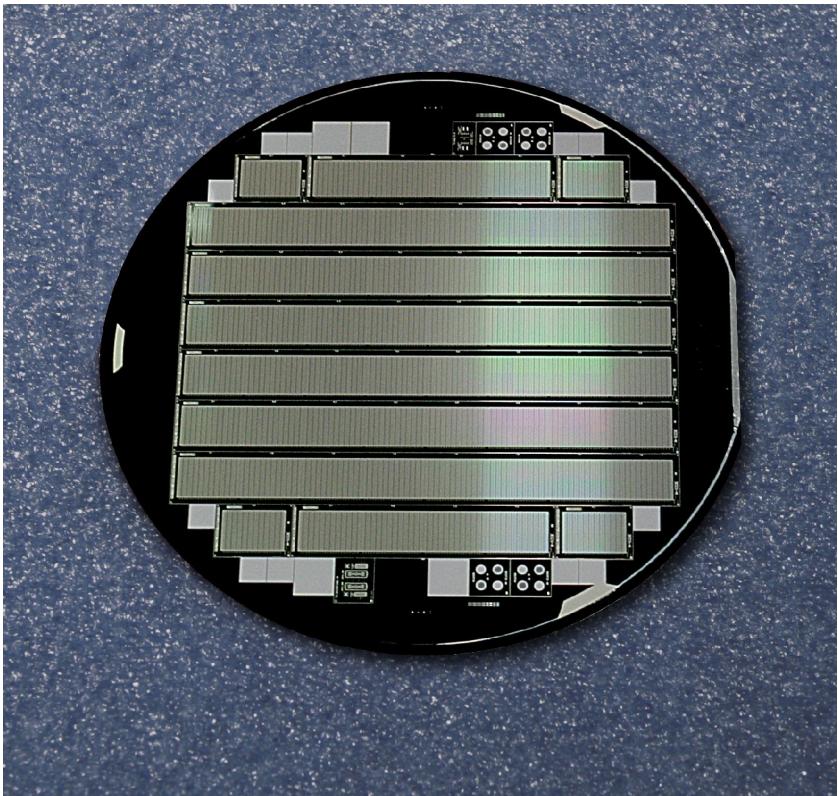
Hybrid Pixel R&D After BTeV

- As of two years ago:
 - FNAL-designed readout chip had two minor fatal flaws.
 - No system demonstration had yet been done.
- An “extended closeout” R&D program was approved
 - 1 more chip submission.
 - R&D refocused on ILC.
 - Two system tests approved:
 - Telescope for the forward direction of PHENIX (at RHIC)
 - Test beam telescope

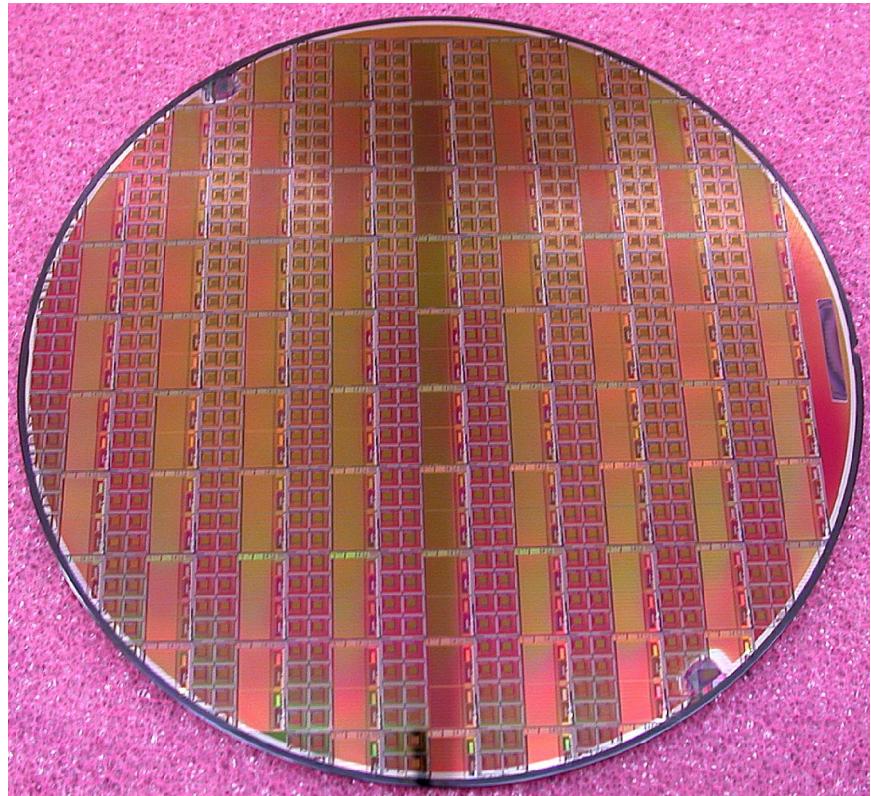
PHENIX: identify charm decays to (forward) muons



Sensor & FPIX2.1 wafers

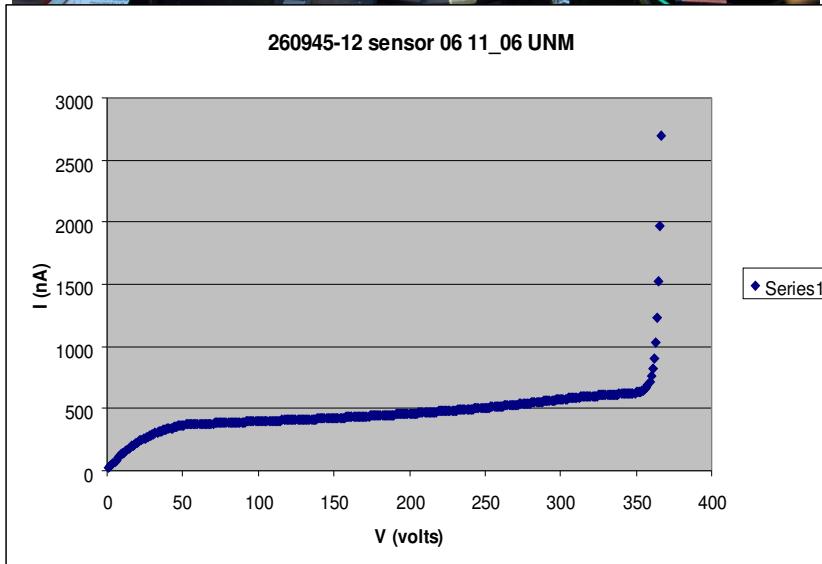
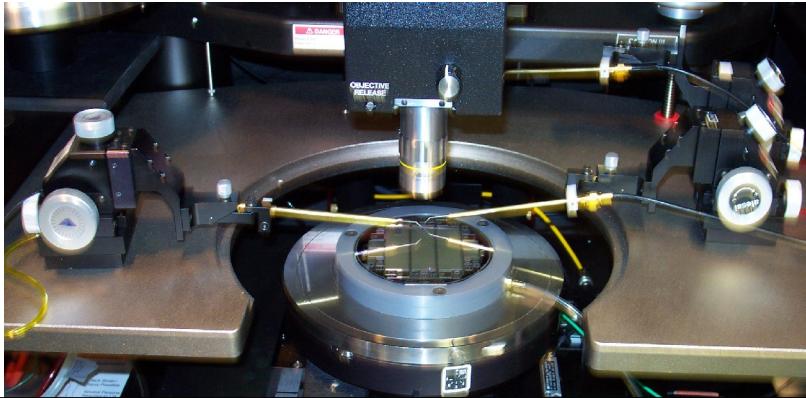


Sensor wafers produced for PHENIX by CiS (enough extras for a MIPP detector)

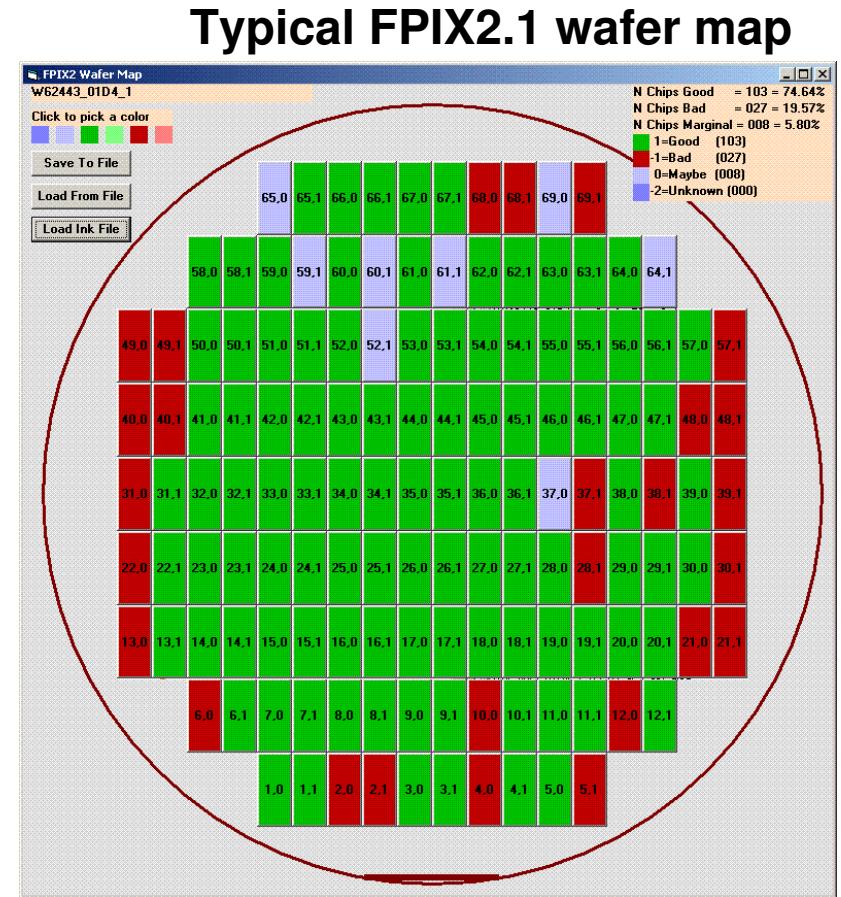


FPIX2.1 fabricated on wafer with “TripT” for D0; fatal flaws fixed; Wafers produced for PHENIX (enough extras for a MIPP detector)

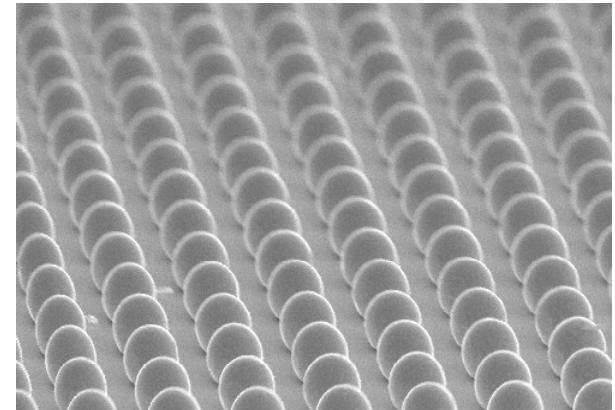
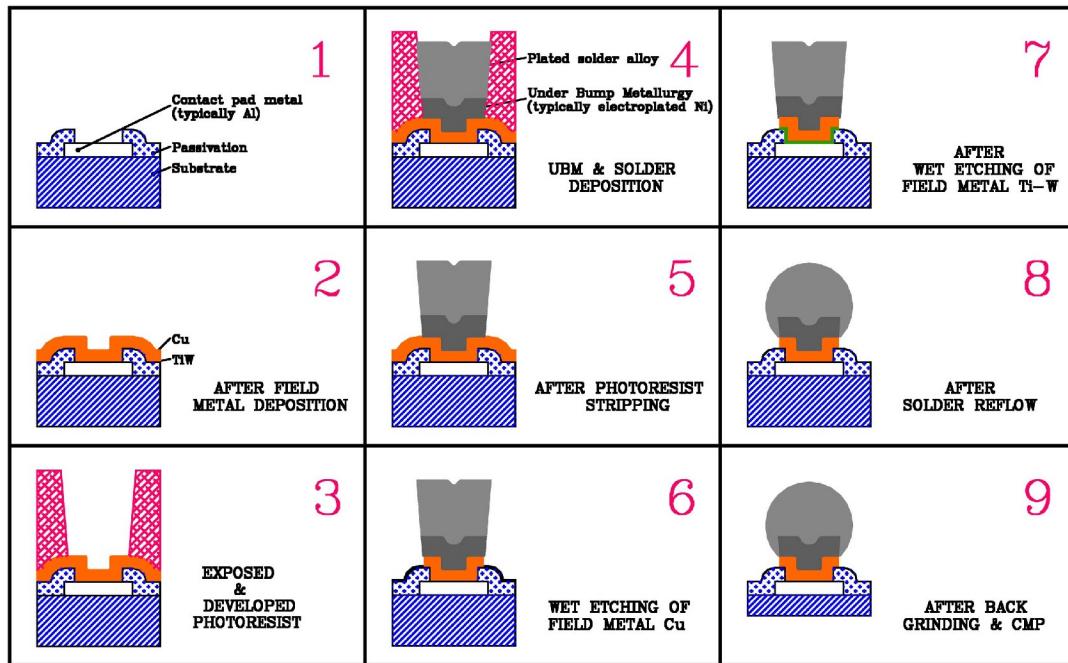
Sensors & ROCs probed – yield is high



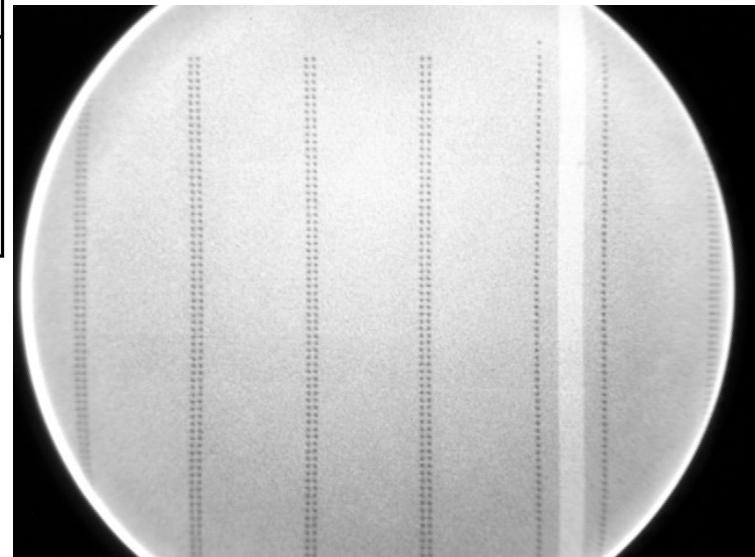
Typical sensor IV curve



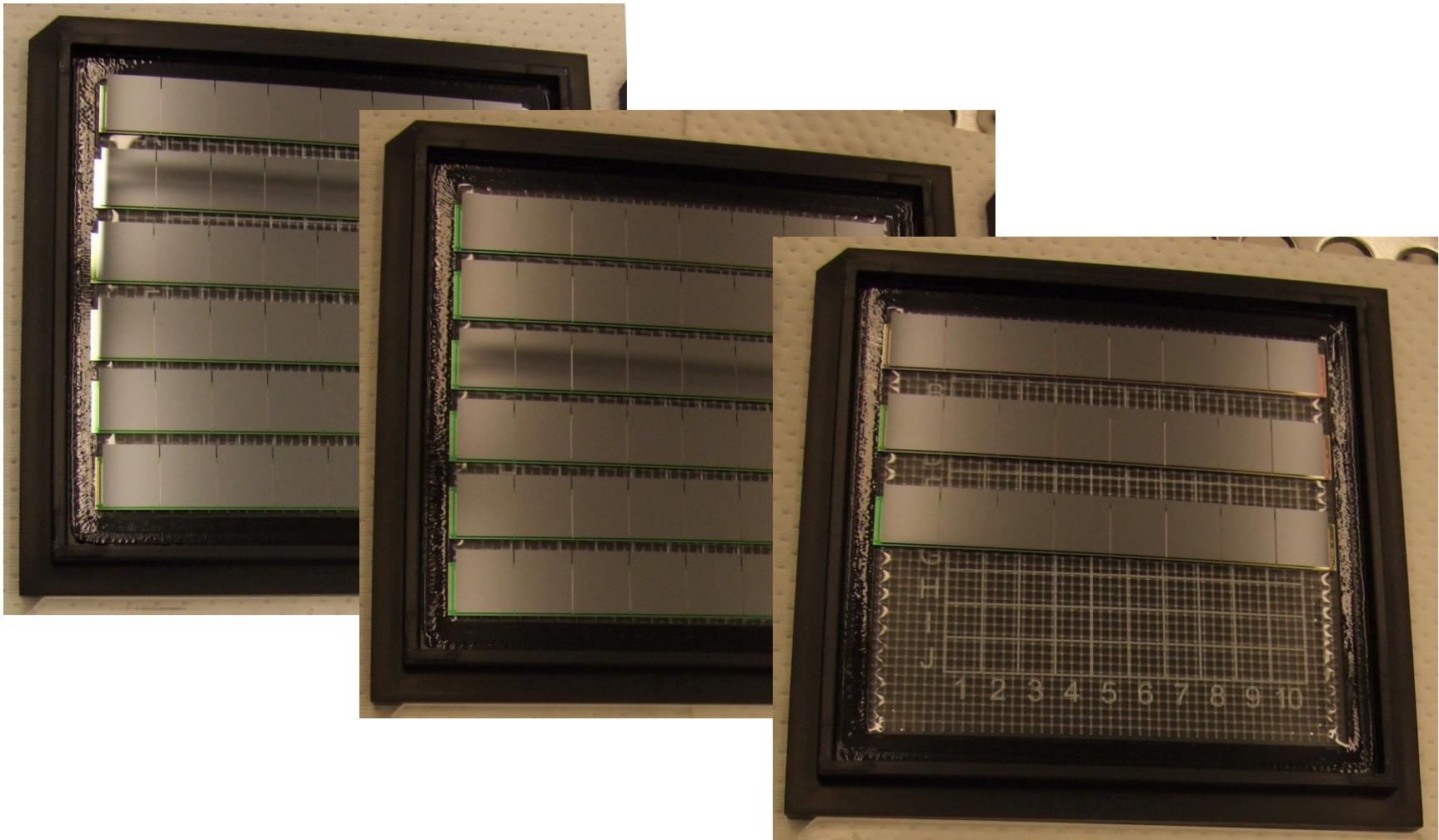
Hybridization – solder bump bonding done by VTT (Finland)



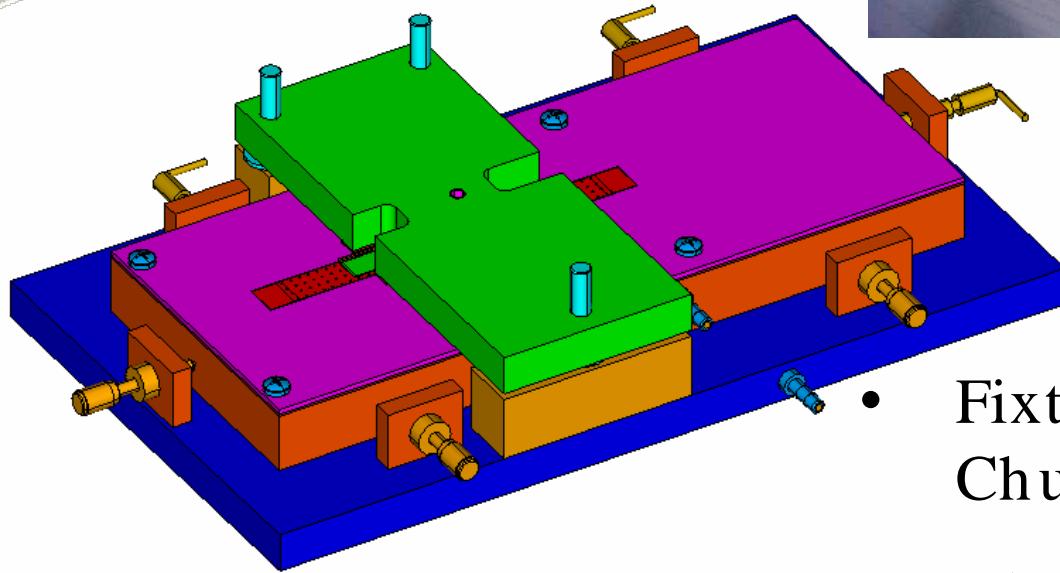
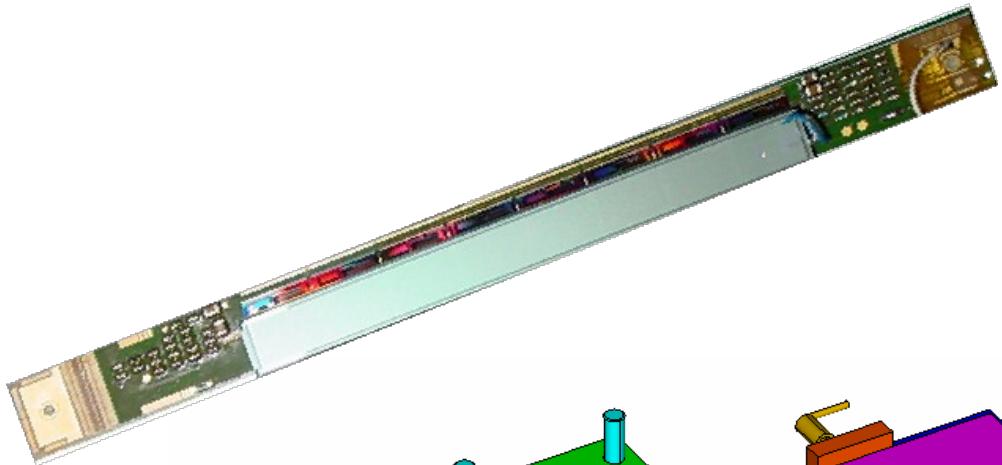
X-ray made at FCC



15 Pre-production PHENIX hybrids delivered 12 April 2007

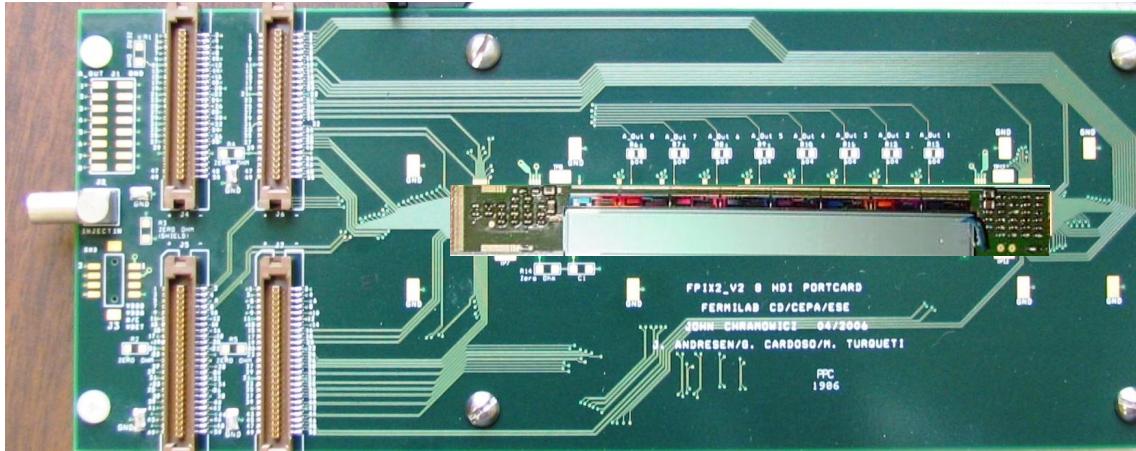


Pixel Module Assembly

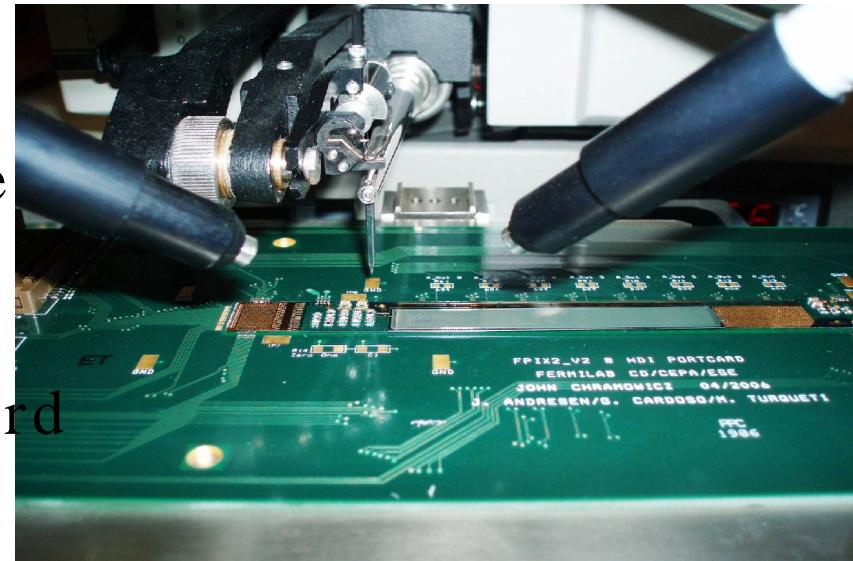


- Fixture with Vacuum Chuck
- Gluing of FPIX to HDI

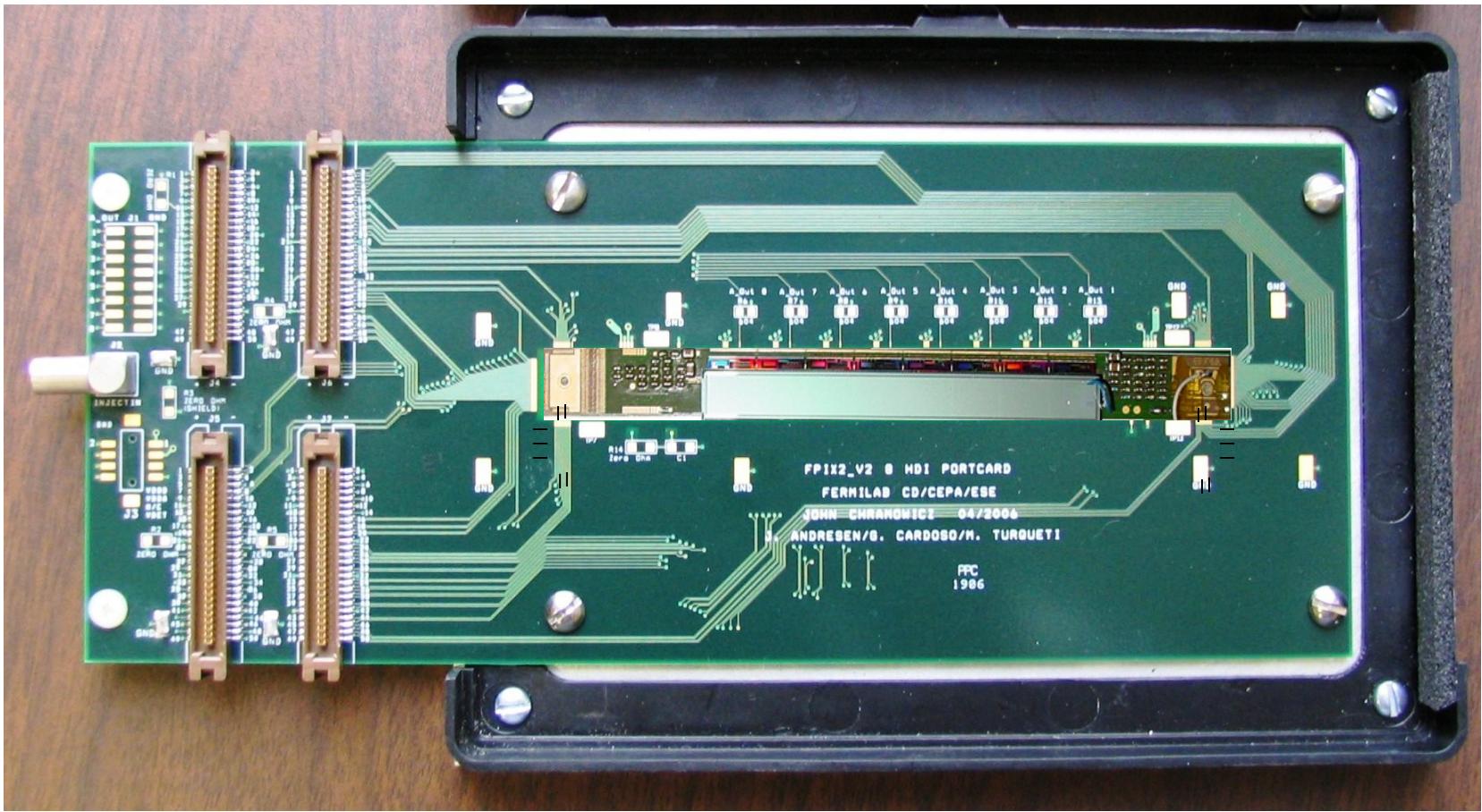
Testcard and Wire Bonding



- Testcard for each module
- Gluing of module to card
- Wirebonding of HDI to card



Ready Test Card



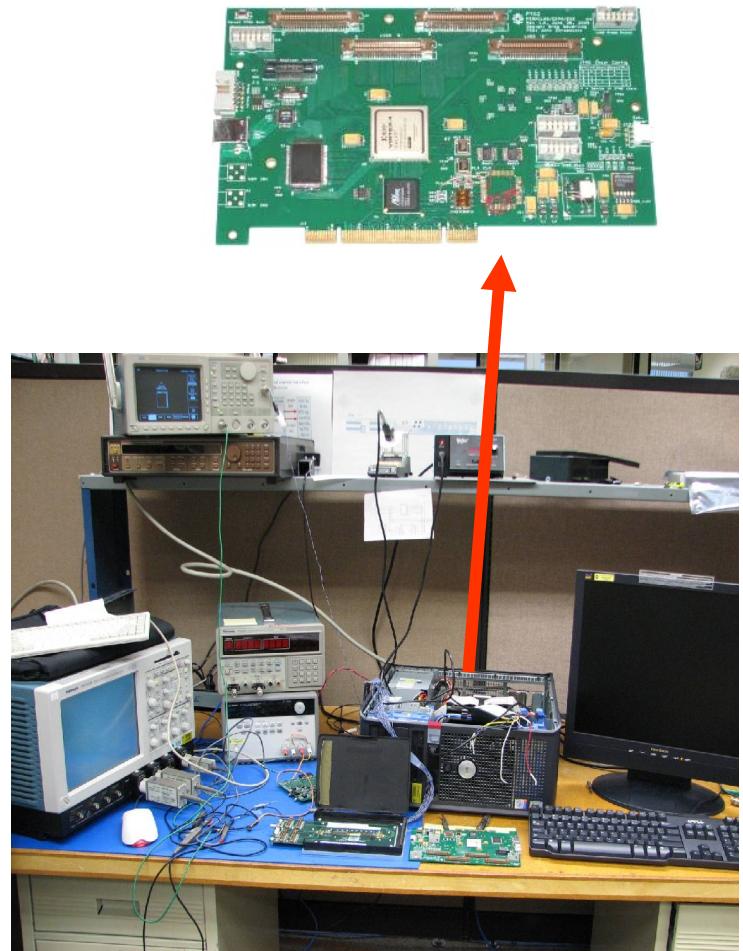
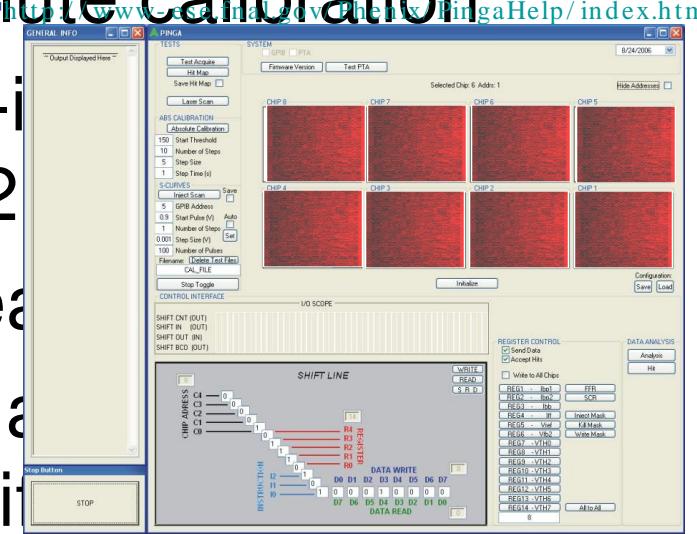
Bench Tests

- Perform module test
 - ‘PINGA’ test software
 - Initial characterization with inject pulser
 - Hit map
 - Absolute calibration

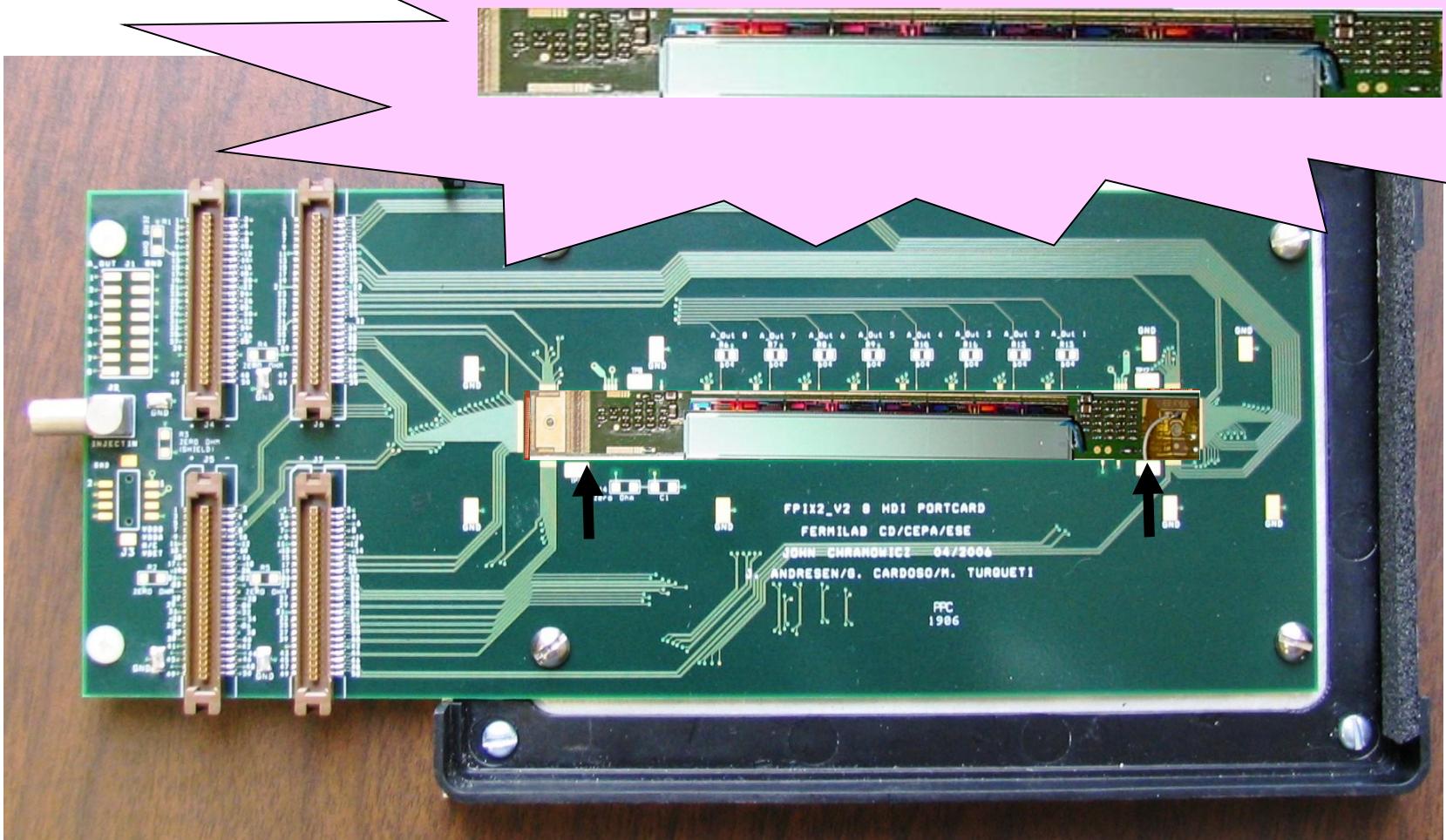


Burn-in

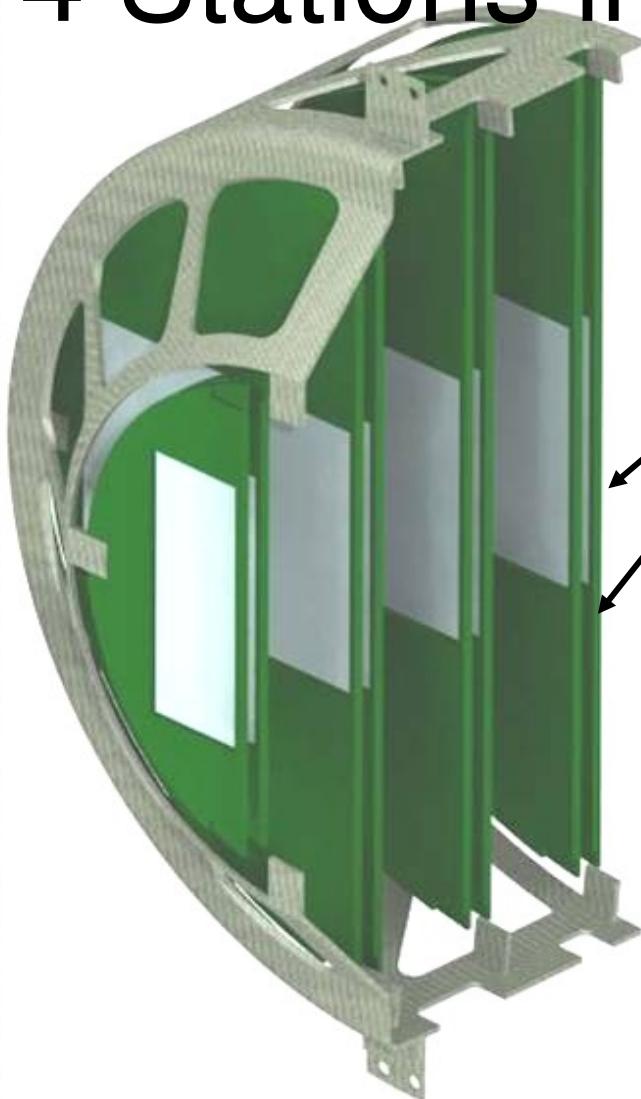
- Repeatability
- Q&A and classification



Module Removal for Plane Assembly

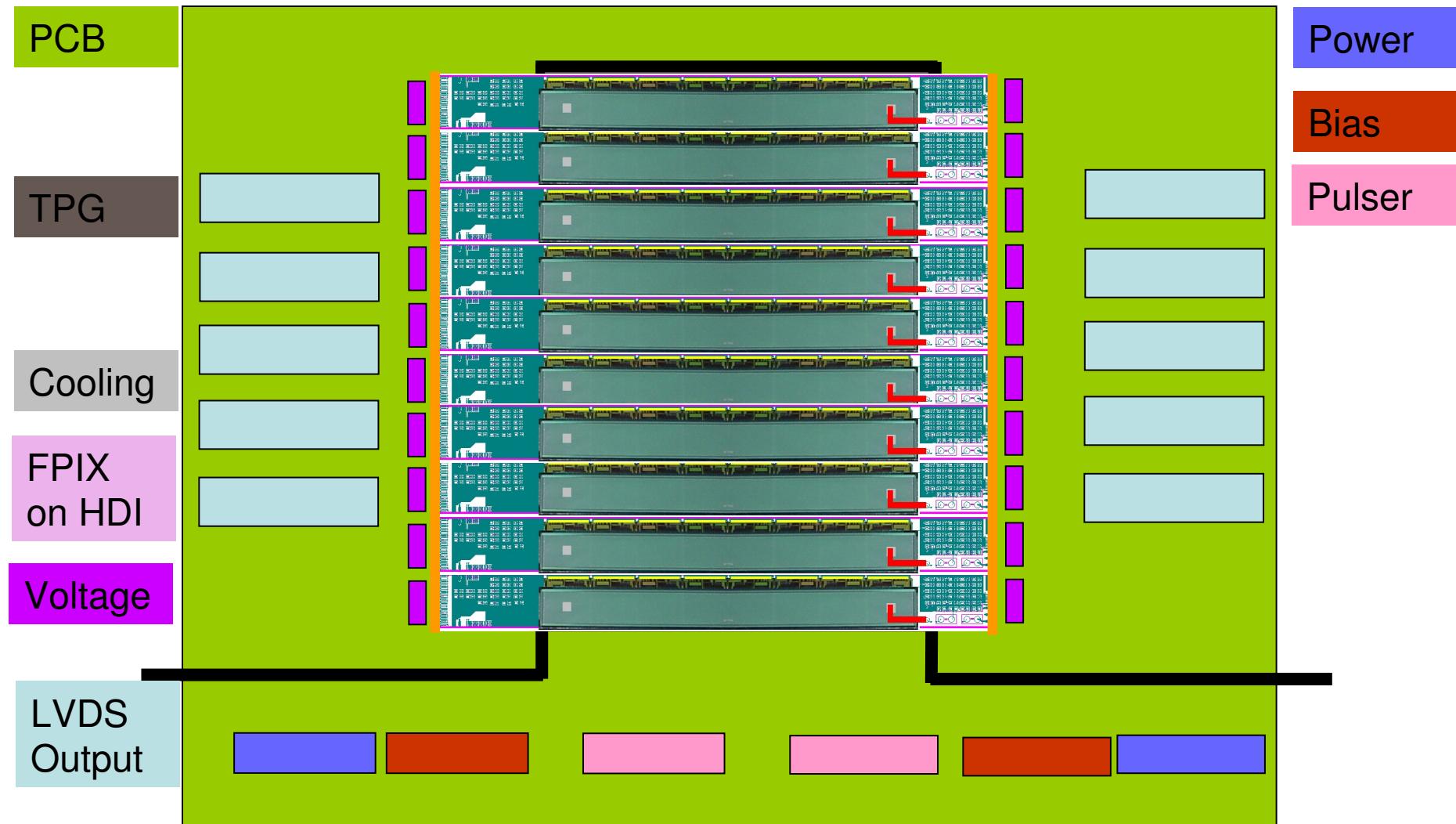


4 Stations in FVTX Frame

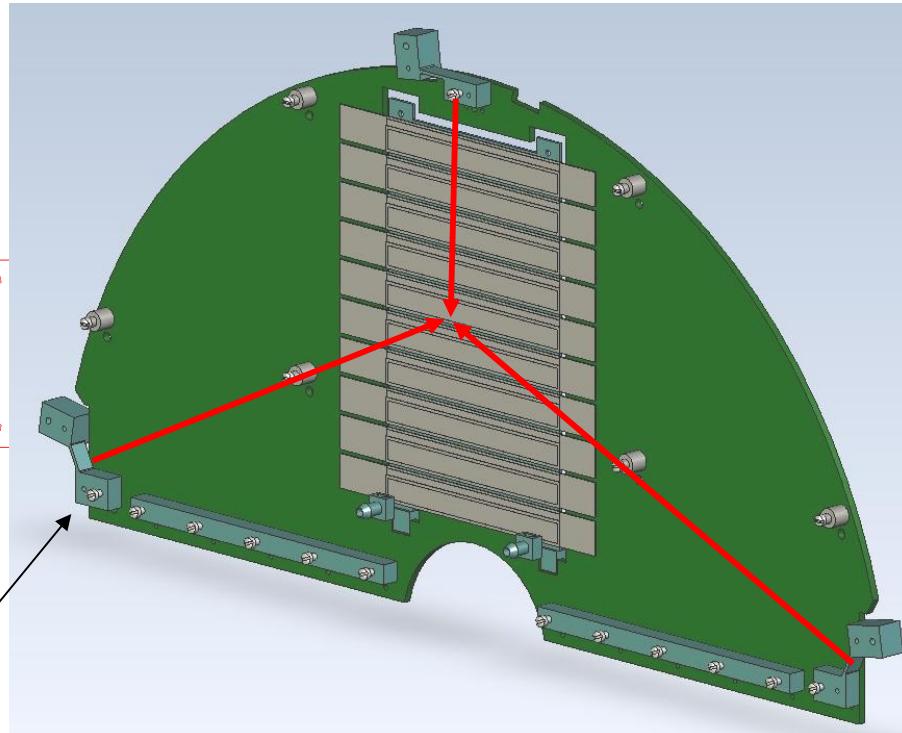
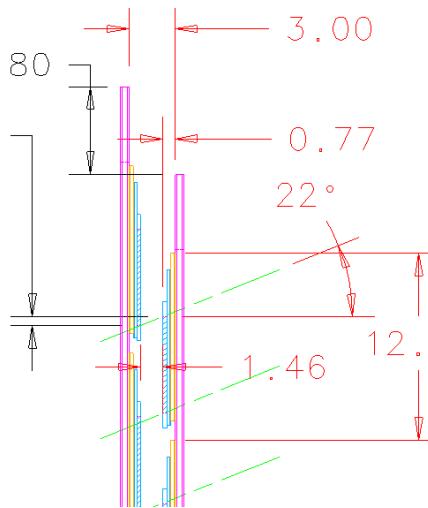


- 2 **Planes** per Station
- 6 Identical Planes for Stations 2,3,4
- Smaller Plane for Station 1
- Room Temperature

The Layout of a Plane



The Actual Plane and Stations

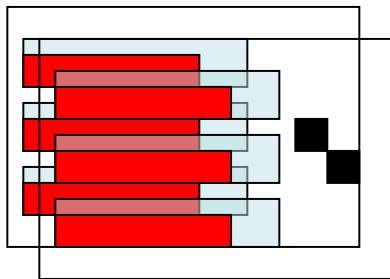


- Flex Blades (Temperature compensation)
- Two Planes Sandwich to get Station
 - Modules Inside
 - Connectors Outside

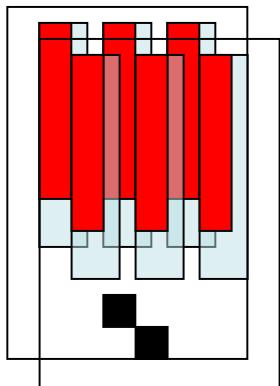
New test beam telescope



Half-plane = three 1x4 modules
read out by 1 FPGA

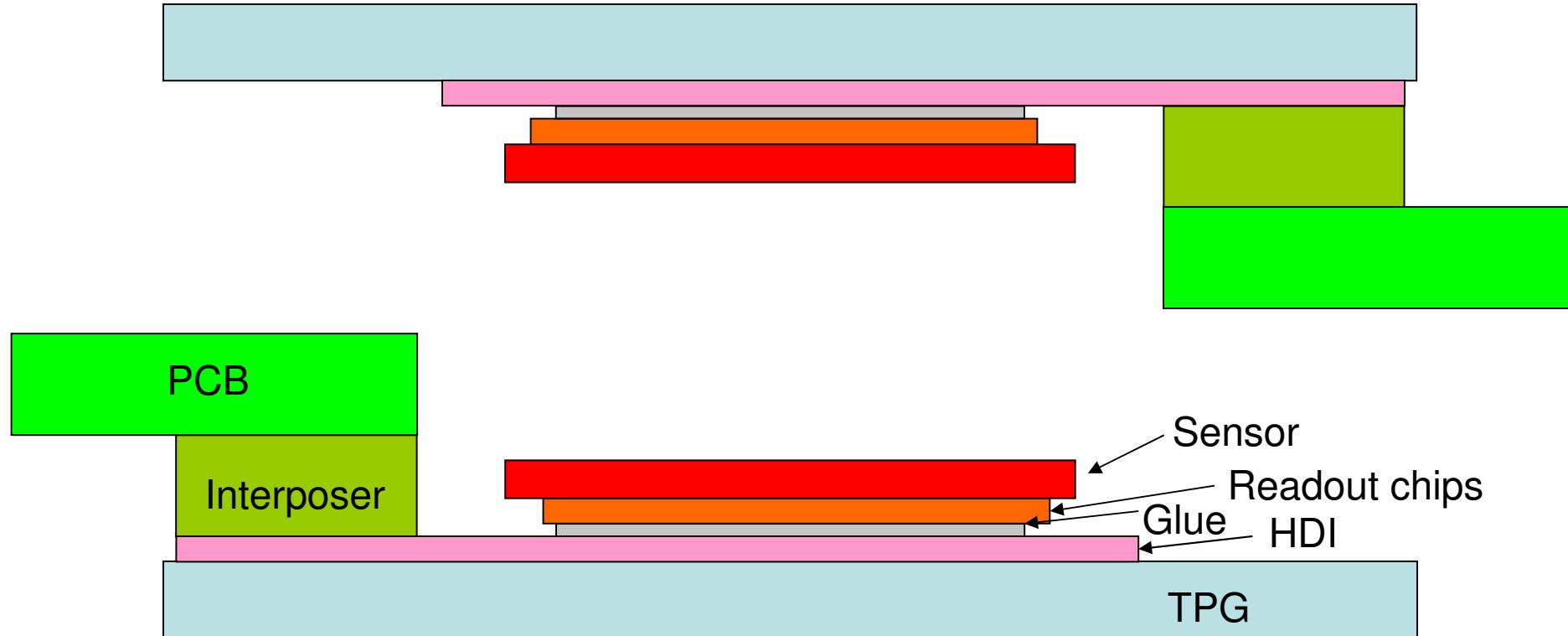


Station = two half-planes
offset by active area of sensor

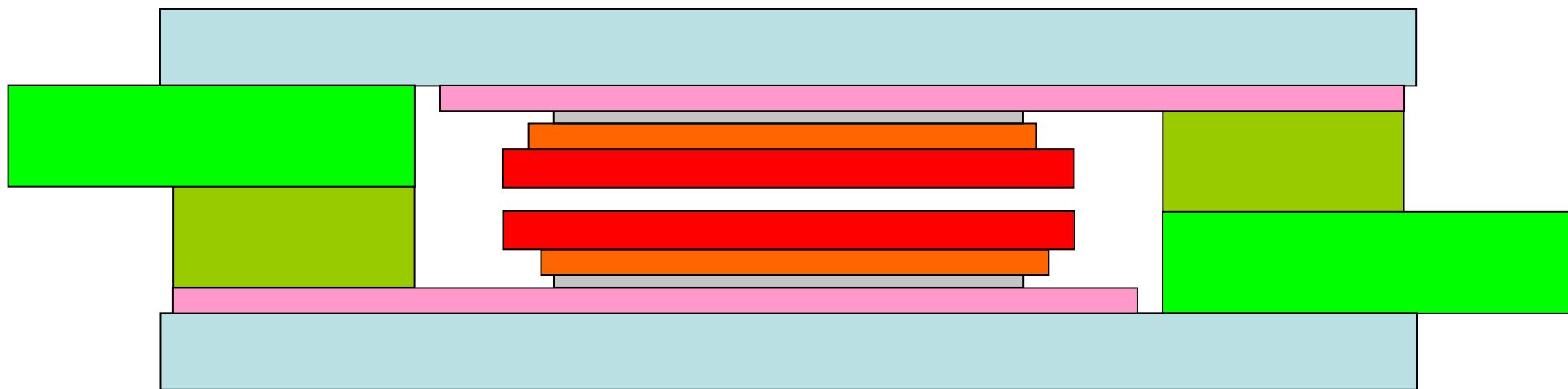


2 stations upstream of
DUT & 2-4 downstream
(precision x & precision y)

Concept for pixel plane



More compact than PHENIX layout;
still maybe too much material close
to active area for MIPP?



Proposal for MIPP

- Build a 3-station detector (1 before target and 2 after; all pixels in one orientation).
 - Provide a “bulls eye” trigger.
 - Measure charm decay vertices?
- Use Testbeam-style readout system.
 - Need to understand how to merge data stream with the rest of MIPP data.
- Use pixel “fast or” signals in MIPP trigger.

Help Needed!

- Design not yet optimized:
 - Station design/location
 - Aperture
- No one yet working on trigger.
- Will also need to assemble a team to build the detector.
 - Test modules at each stage of construction.
 - Test subsystems.
 - Integrate system into MIPP.